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(54) Automatic Vending Machines

(57) In an automatic vending machine having a plurality of thermally insulated article-storage chambers (12) for vending articles to be heated and/or articles to be cooled, electric heated elements (16) are disposed in respective article-storage chambers so that any one of article-storage chambers may be used for storing articles to be heated by energizing the heater element in the chamber. In order to use each chamber (12) as a refrigerating chamber, the machine cabinet is provided with a thermally insulated cooling chamber (20) under the article-storage chambers in which a refrigerant evaporator (22) of a refrigerating system and a blower (26) are disposed. Each article-storage chamber is formed with two ports (23,24) connecting with the cooling chamber and has shutter plates (27,28) for closing the ports. Each article-storage chamber can be connected with the cooling chamber through its ports which are opened by moving the shutter plates so that the cooled air in the cooling chamber may be circulated through the article-storage chamber and the ports to refrigerate the article-storage chamber.

FIG. 2

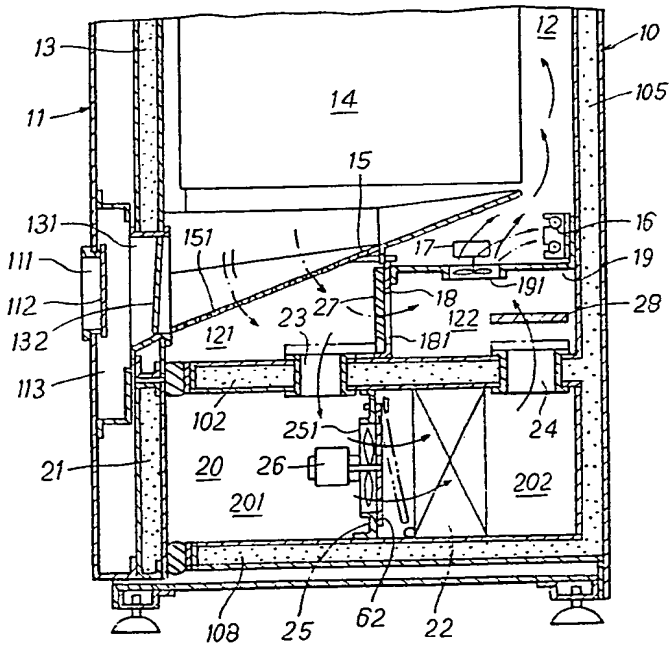

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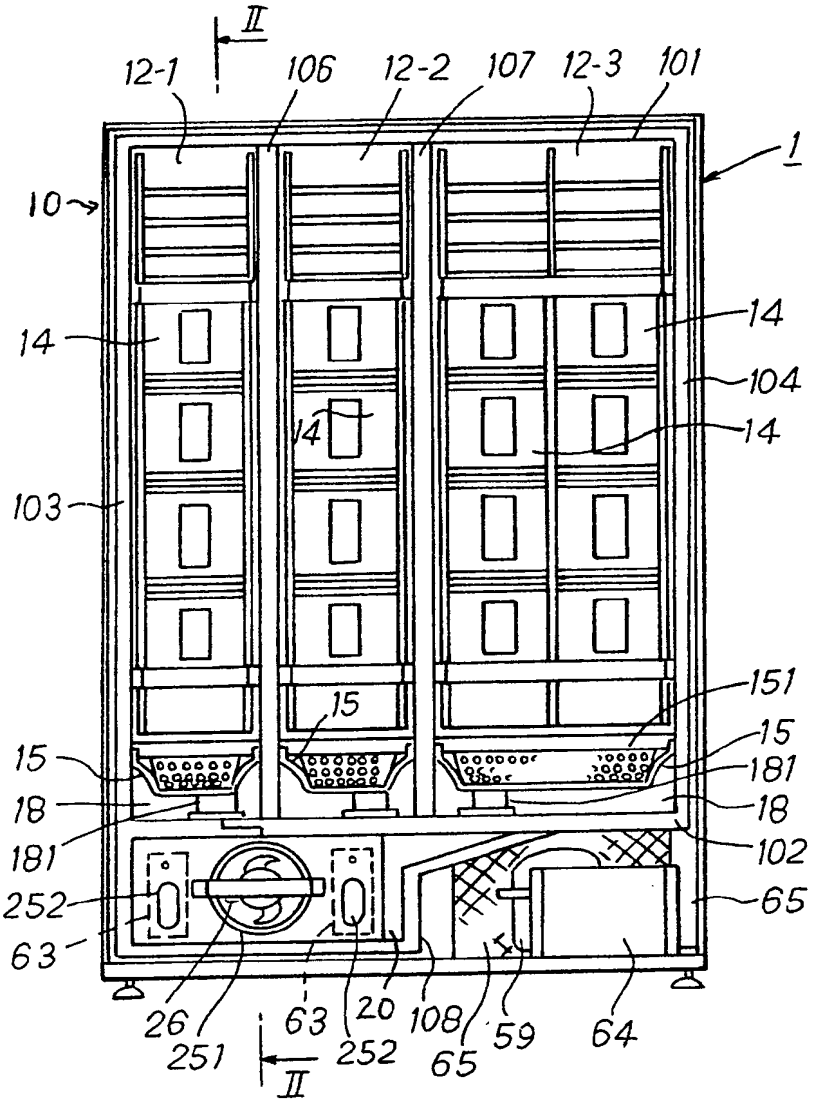
FIG. 1



SPECIFICATION

Improvements in or Relating to Automatic Vending Machines

This invention relates to automatic vending machines.

Various kinds of articles have been handled in automatic vending machines. In particular, cans or bottles containing beer, fruit juice, coffee, black tea and other liquor have been sold by automatic vending machines having refrigerating systems to refrigerate articles to be sold, so that the purchasers might enjoy, for example, cooled beer. Recently, automatic vending machines having heating systems to heat or warm articles to be sold have been used to sell coffee-containing cans or others.

A known vending machine for vending different kinds of articles has a plurality of article-storage chambers for storing different kinds of articles. In order to store articles to be heated, such as coffee-containing cans, all articles to be cooled, such as beer-containing cans, each article-storage chamber must be thermally insulated and be provided with heater means or refrigerating means. A vending machine which has at least one thermally insulated article-storage chamber including refrigerating means and at least one thermally insulated article-storage chamber including means, can be used for vending both articles to be heated and articles to be cooled. But, if it is not intended to vend articles to be heated, the article-storage chamber having the heating means is not used but remained empty.

In order to remove such a disadvantage, a vending machine is known wherein a plurality of apertures are formed in a thermally insulating wall between adjacent article-storage heating chamber and article-storage refrigerating chamber. Shutter means are provided to close the apertures to use those adjacent two chambers to heat and refrigerate articles therein, respectively. If the shutter means are moved to open those apertures and if the heater means in the heating chamber are operated, both of the chambers can be used for storing articles to be heated. In order to use both chambers for storing articles to be cooled, the shutter means are moved to open those apertures and the refrigerating means in the other refrigerating chamber are operated.

In the known vending machine, it is impossible to use the article-storage heating chamber as a chamber for storing articles to be cooled while using the article-storage refrigerating chamber as a chamber for storing articles to be heated. This requires operators to take care for the difference of chambers at a time when articles are loaded. Furthermore, if the article containing capacity of the article-storage heating chamber is larger than that of the article-storage refrigerating chamber, the vending machine is improper to vend more articles to be cooled than articles to be heated. Therefore, it is desired that each chamber can be selectively used for either one of a heating chamber and a refrigerating chamber. To this end, it is also known in the prior art that both of heating means and refrigerating means are provided to each article-storage chamber. But since the refrigerating means comprises a plurality of devices such as compressor, condenser, evaporator and others, the provision of a plurality of refrigerating means makes the automatic vending machine large in volume and high in cost.

According to this invention, a vending machine having a plurality of article-storage chambers thermally insulated each of which is selectively usable for storing either articles to be heated or articles to be cooled, comprises heating means mounted in each article-storage chamber, fan means mounted in each article-storage chamber for circulating air therein, refrigerating means including refrigerant evaporating means, a cooling chamber containing the refrigerant evaporating means, each article-storage chamber having first and second ports which connect with the cooling chamber, blower means mounted within the cooling chamber for sucking air into the cooling chamber through the first port of each article-storage chamber and discharging cooled air into each article-storage chamber through the second port, and first and second shutter means for closing the first and second ports of each article-storage chamber, whereby each article-storage chamber may be used as a heating chamber at a time when the first and second ports are closed by the shutter means and as a refrigerating chamber at a time when the first and second ports are open.

Suitably, a plurality of article-storage chambers are arranged in parallel with one another in a machine cabinet and the cooling chamber is made at the lower portion of the machine cabinet and below the article-storage chambers. A compressor-containing chamber may also be made at the lower portion of the machine cabinet to arrange in parallel with the cooling chamber but under a portion of the cooling chamber.

Suitably, a partition wall is provided to divide the cooling chamber into two sections one of which connects with the first port of each article-storage chamber, with the other connecting with the second port of each article-storage chamber. The partition wall is formed with a hole in which the blower means is disposed to make air-flow from the first port to the second port. The partition wall is also provided with additional openings at both sides of the fan disposed hole, and the additional openings are closed by valve members or damper plates to automatically control the amount of air flowing through the cooling chamber in response to the number of article-storage chambers connected with the cooling chamber.

The invention will now be described, by way of example with reference to the accompanying drawings in which:—

Fig. 1 is a front view of an embodiment of a vending machine according to this invention, a front door disassembled;

Fig. 2 is a sectional view of a main part taken along a line II—II in Fig. 1;

Fig. 3 is a perspective view of shutter mechanism used in the embodiment; and

Fig. 4 is a circuit diagram for controlling heater means, refrigerant compressor, and fan motors.

Referring to Figs. 1 and 2, a vending machine shown therein includes a machine cabinet 10 with a front door 11 connected at one of its vertical edges thereto by hinges. Front door 11 is formed with an access or delivery opening 111 through which a discharged article is obtained. Access opening 111 is normally closed by a downwardly swingable door 112.

Machine cabinet 10 has a plurality of article-storage chambers 12 (three chambers are shown 12—1—12—3) which are defined by surrounding adiabatic walls 101—105 and partitioning adiabatic walls 106 and 107, so that article-storage chamber 12—1—12—3 may vertically extend in parallel with one another. Article-storage chambers 12—1—12—3 have front openings which are normally closed by a common inner adiabatic door 13. Inner adiabatic door 13 is hinged at its one of vertical edges to machine cabinet 10.

In each article-storage chamber 12, at least one article storage and discharging unit device 14 is disposed. The article storage and discharging unit device is one which stores articles to be sold and discharges articles one at a time. As the article storage and discharging unit device, various type such as a surpentine track, a rotative spiral element as shown in U.S. patent 2,918,195, and other devices are well known in the prior art, This invention is not directed to the article storage and discharging unit device and, therefore, the description and schema of the unit are omitted for simplification.

A forwardly declined chute 15 is mounted at the lower portion in each article-storage chamber 12, to receive articles discharged from article storage and discharging unit device 14 therein, and to transfer the articles into a pocket 113 formed in front door 11. Inner adiabatic door 13 is provided with openings 131 to connect the forward ends of chutes 15 and pocket 113. Each opening 131 is normally closed by a downwardly swingable door 132. Accordingly, an article discharged from a certain article storage and discharging unit device 14 is received on chute 15 under the unit device 14 and slides downwardly and received in pocket 113 after passing through opening 131 by pushing door open. Thus, the article in pocket 113 is obtained through access opening 111.

In each article-storage chamber 12, heating element 16 is mounted to heat the interior of the chamber. In order to scatter air heated by heating element 16 all over the interior of the chamber 12, an electric fan 17 is mounted in the chamber 12.

A partitioning wall 18 is vertically disposed under chute 15 within each article-storage chamber 12 to form two divided forward and rearward spaces 121 and 122, and is provided with a hole 181 to communicate between the divided spaces. A plate member 19 is disposed in space 122 to extend horizontally between the upper end of partitioning wall 18 and rear wall 105. Electric fan 17 is mounted in a hole 191 formed in plate member 19. Heating element 16 is mounted on the inner surface of rear wall 105 above plate member 19. In operation of electric fan, air is blown out of rear space 122 through hole 191 to heating element 16. The air heated by heating element 16 flows upwardly within article-storage chamber 12 and flows into article storage and discharging unit 14 from its rear opening. The air heats articles in unit device 14 and flows out of the unit from its lower end opening. Chute 15 is formed with many holes 151 at a portion over forward space 121. Therefore, the air from the article discharging unit 14 flows into forward space 121 through many holes 151 and returns into rearward space 122 through hole 181. Thus, air circulates within article-storage chamber 12 and is heated by heating element 16 in the course of the circulation so that articles stored within article discharging unit 14 may be heated or warmed.

As easily understood from the above description each article-storage chamber 12 can be used as a heating chamber by energizing heating element 16 therein.

In order to make it possible to use each article-storage chamber 12 as a refrigerating chamber, a cooling chamber 20 is formed in machine cabinet 10. Cooling chamber 20 is formed under all article-storage chambers 12 and is thermally insulated from article-storage chambers 12—1—12—3 by adiabatic wall 102. Cooling chamber is surrounded by adiabatic walls 108 with remaining a front opening which is normally closed by an adiabatic door 21 which is hinged at one of its vertical edges to machine cabinet 10. A refrigerant evaporator 22 is disposed within cooling chamber 20 to separate cooling chamber 20 into forward space 201 and rearward space 202. Adiabatic wall 102 is formed with ports 23 for communicating all forward spaces 121 of all article-storage chambers 12 and forward spaces 201 of cooling chamber 20, and with another ports 24 at its rearward portion for communicating all rearward spaces 122 of all article-storage chambers 12 and rearward space 202 of cooling chamber 20. A plate member 25 having a hole 251 is disposed in front of refrigerant evaporator 22 and a blower 26 is disposed in hole 251 to suck air into space 201 through forward ports 23 and to blow out through rearward ports 24 after passing evaporator 22. Accordingly, when blower 26 and refrigerating system including refrigerant evaporator 22 are in operation, the air cooled by evaporator 22 is blown into each rear space 122 through each rear port 24 and, then, passes through article discharging unit 14 in the article-storage chamber 12 to its forward space 121 by operation of electric fan 17, and returns to forward space 201

of cooling chamber 20 through forward port 23. Therefore, each article-storage chamber 12 can be used as a refrigerating chamber by operation of blower 26 and refrigerating system but by stopping the energization of each heating element 16.

Shutter plates 27 and 28 are provided to forward and rearward ports 23 and 24 of each article-storage chamber 12 to close those ports at a time when the article-storage chamber is used as a heating chamber. When the article-storage chamber is used as a refrigerating chamber, those shutters 27 and 28 are moved to open ports 23 and 24. At that time, shutter 27 is used to close hole 181 connecting between forward and rearward spaces 121 and 122 so that the air within forward space 121 may be sucked into cooling chamber 20 through forward port 23 without being short-circuited into rearward space 122.

Referring to Fig. 3, forward and rearward shutters 27 and 28 in each article-storage chamber 12 are moved at a time by operation of a handle 29. Two L-shaped seat plates 30 and 31 are fixedly disposed along forward and rearward edges of rearward port 24. An operating rod 32 having handle 29 is supported by forward L-shaped seat plate 30 and a supporting plate 33 fixedly disposed near the forward edge of forward space 121, and is rotatable by the operation of handle 29. Operating rod 32 extends from handle 29 of its forward end through a cut-away portion 182 of partitioning wall 18 to its rearward end at which a link 34 is fixedly mounted to be rotatable together with rotation of operating rod 32. The end of link 34 is pivoted to the forward end of shutter plate 28 by a pin 35. The forward end of shutter plate 28 is also connected to forward seat plate 30 by a similar link 36 and pins 37 and 38. A pair of similar links 39 and 40 are also provided to connect between the rearward end of shutter plate 28 and rearward L-shaped seat plate 31. A connecting rod 41 joins opposite links 34 and 40 to move together with one another. Accordingly, when handle 29 is rotated, link 34 and, therefore, link 40 are rotated thereby to move shutter plate 28. Another opposite links 36 and 39 are drawn by shutter plate 28 to be rotated. Therefore, shutter plate 28 is moved upwardly or downwardly by rotating handle 29 in an direction or the opposite direction so that rearward port 24 may be open or closed. When shutter plate 28 is moved downwardly to close rearward port 24, a spring 42 is provided to generate a force to urge shutter plate 28 onto the edge of port 24 so that port 24 may be tightly closed. Forward shutter 27 is hinged at its rearward edge to partitioning wall 18 by a pivot shaft 48 to be swingable upwardly. Twisted coil springs 49 and 50 are mounted on pivot shaft 48 and both ends of each spring are connected to shutter plate 27 and partitioning wall 18 so that shutter plate 27 may be urged to the edge of forward port 23. As a result, port 23 is tightly closed. A cord 51 is provided to connect shutter plate 27 and link 34 so that shutter plate 27 may be swung by rotation of link 34.

Forward and rearward ports 23 and 24 are closed by respective shutters 27 and 28 in the condition shown in Fig. 3. When handle 29 is rotated in the clockwise direction from the condition shown in Fig. 3, each link 35, 37, 39 and 40 is also rotated in the direction so that shutter plate 28 is raised upwardly to open rearward port 24. At that time, link 34 draws cord 51 so that shutter plate 27 may be swung upwardly against closing force by twisted springs 49 and 50. As a result, forward port 23 is also open and hole 181 is closed by shutter plate 27 upwardly swung.

When forward and rearward ports 23 and 24 of a certain article-storage chamber 12 is closed by shutter plates 27 and 28 in the condition shown in Fig. 3, the article-storage chamber 12 can be used as a heating chamber by energizing heating element 16 in the chamber. If the article-storage chamber 12 is desired to be used as a refrigerating chamber, handle 29 in the chamber is rotated in the clockwise direction to open ports 23 and 24 and to close hole 181. The chamber 12 can be used as a refrigerating chamber by actuating blower 26 and refrigerating system including evaporator 22 but stopping energization of heating element 16 in the chamber.

As described above, any one of article-storage chambers 12—1—12—3 can be used as a heating chamber by closing forward and rearward ports 23 and 24 in the chamber and it can be also used as a refrigerating chamber by opening ports 23 and 24 to connect with cooling chamber 20. Therefore, the vending machine of this embodiment can be used in various cases, for example, a case when a relatively large amounts of articles to be heated are desired to be sold in comparison with that of articles to be cooled, or another case when amounts of articles to be heated are, on the contrary, small in comparison with that of articles to be cooled.

In order to control heating element 16, blower 26 and refrigerating system by operation of handle 29 in each article-storage chamber 12, at least one microswitch (two switches 52 and 53 are shown in Fig. 3) is mounted in each article-storage chamber 12 near operation rod 32, and is connected in a circuit for controlling heating elements 16, blower 26 and refrigerating system as shown in Fig. 4. Microswitches 52 and 53 are ones for detecting whether ports 23 and 24 are closed or open. When ports 23 and 24 are closed by respective shutter plates 27 and 28 as shown in Fig. 3, microswitches 52 and 53 do not engage with an actuator 54 which is fixed onto operating rod 32. When ports 23 and 24 are open by rotating handle 29 in the clockwise direction, actuator 54 engages with microswitches 52 and 53. Therefore, whether ports 23 and 24 are closed or open is detected by microswitches 52 and 53.

Referring to Fig. 4, heater elements 16, fan motors of electric fans 17 and microswitches 52 and 53 in respective article-storage chambers

12—1—12—3 are represented by those reference numerals 16, 17, 52 and 53 with suffix numbers 1, 2 and 3 corresponding to chambers 12—1, 12—2 and 12—3. Fan motors 17—1, 17—2 and 17—3 are connected to an AC power source 55 in parallel with one another through a power switch 56. An end of heating element 16- -1 in article-storage chamber 12—1 is connected to a terminal of power source 55 through break contact of microswitch 52—1 and power switch 56, while the other end is connected to the other terminal of power source 55 through break contact of microswitch 53—1.

In each article-storage chamber, a thermo-sensitive switch 57 and a thermally operated circuit breaker 58 are disposed for detecting a predetermined temperature to control the temperature within the chamber and for breaking the circuit at a time when the temperature within the chamber is elevated excessively. In Fig. 4, switches 57 and breakers 58 in respective chambers are represented by those numerals 57 and 58 with suffix numbers 1, 2 and 3 corresponding to chambers 12—1, 12—2 and 12—3.

Thermo-sensitive switch 57—1 and thermally operated circuit breaker 58—1 are connected in series between heating element 16—1 and microswitch 53—1.

Therefore, when ports 23 and 24 in article-storage chamber 12—1 are closed as shown in Fig. 3, heating element 16—1 is energized through break contacts of non-operated microswitches 52—1 and 53—1 when power switch 56 is turned on. The interior of the chamber 12—1 is heated to a predetermined temperature and is maintained at the temperature by on-off operation of thermo-sensitive switch 57—1.

Break contact of microswitch 52—2, heating element 16—2, thermally operated circuit breaker 58—2, thermo-sensitive switch 57—2 and break contact of microswitch 53—2 in article-storage chamber 12—2 are connected in series with one another and connected to power source 55 through power switch 56, similar to those in article-storage chamber 12—1. Similarly, break contact of microswitch 52—3, heating element 16—3, thermally operated circuit breaker 58—3, thermo-sensitive switch 57—3 and contact of microswitch 53—3 in article-storage chamber 12—3 are connected to power source 55 through power switch 56 in series with one another. Therefore, article-storage chambers 12—2 and 12—3 are also used as heating chambers which are temperature-controlled at respective predetermined temperatures at a time when ports 23 and 24 in chambers 12—2 and 12—3 are respectively closed.

A refrigerant compressor 59 of the refrigerating system is connected to the power source 55 through power switch 56 and a relay contact 60—1 of a relay 60. Make contacts of microswitches 52—1, 52—2 and 52—3 are commonly connected to a terminal of relay 60 through a thermo-sensitive switch 61 which is mounted on refrigerant evaporator 22 in cooling chamber 20. The other terminal of relay 60 is connected to power source 55. Therefore, when at least one of microswitches 52—1, 52—2 and 52—3 is actuated, relay 60 is energized and refrigerant compressor 59 is, then, driven by make contact 60—1 of relay 60. Accordingly, cooling chamber 20 is cooled at a time when at least one of article-storage chambers 12—1, 12—2 and 12—3 are connected with cooling chamber 20 through its ports 23 and 24, and the cooled air is blown into the article-storage chamber 12 through the open port 24 and returns through open port 23. Blower 26 in cooling chamber 20 is connected in parallel with thermo-sensitive switch 61 and relay 60 and are, therefore, driven at a time any one of micro-switches 52—1, 52—2 and 52—3 are actuated. Thus, article-storage chamber 12 is cooled and is used as a refrigerating chamber. The operation of relay 60 is controlled by on-off operation of thermo-sensitive switch 61 and the operation of compressor 59 is, therefore, controlled. So that the temperature of refrigerant evaporator 22 is controlled constant, and the temperature of the interior of article-storage chamber is also maintained constant.

As described above, when handle 29 in at least one of article-storage chambers 12—1, 12—2 and 12—3 is operated to open ports 23 and 24 of the article-storage chamber, microswitch 52 in the article-storage chamber is actuated so that refrigerant compressor 59 and blower 26 are driven. Therefore, the article-storage chamber is automatically exchanged from a heating chamber to a refrigerating chamber only by operation of handle 29.

A fan motor 62 is connected in parallel with compressor 59 and is for forcedly air-cooling a condenser of the refrigerating system.

The amount of cooled air blown out of cooling chamber 20 is different depending on the number of article-storage chambers which are used as refrigerating chambers. Furthermore, the amount of the air returning to cooling chamber 20 from article-storage chambers is also different. Therefore, plate member 25 is provided with at least one opening (two openings 252 are shown in Fig. 1) in addition to hole 251. Dampers 63 are fixed onto the rear surface of plate member 25 and are downwardly swingable to normally close opening 252. If the number of article-storage chambers which are connected to cooling chamber 20 is increased, the air pressure at rear space 202 of cooling chamber 20 is lower than forward space 201 so that dampers 63 upwardly swing to open openings 252. Accordingly, the amount of air passing through evaporator 22 and blowing out of cooling chamber 20 in increased.

Refrigerant compressor 59, condenser 64, fan 62 for cooling condenser 64 and other parts of the refrigerating system, are contained in a compressor containing chamber 65 which is

formed at a lower portion of machine cabinet 10. That is, compressor containing chamber 64 is adjacent to cooling chamber 20 and under one or more article-storage chambers. But because cooling chamber 20 is coupled with all ports 23 and 24 of all article-storage chambers 12, cooling chamber 20 partially extends between compressor containing chamber 65 and article storage chamber or chambers above compressor containing chamber 65. Compressor containing chamber 65 communicates with outside of machine cabinet 10, for example, through a net cover 65, as well known in the art.

Claims

1. A vending machine having a plurality of article-storage chambers thermally insulated each of which is selectively usable for storing articles to be heated or articles to be cooled, which comprises heating means mounted in each article-storage chamber, fan means mounted in each article-storage chamber for circulating air therein, refrigerating mean including refrigerant evaporating means, a cooling chamber containing said refrigerant evaporating means, each article-storage chamber having first and second ports which connect with said cooling chamber, blower means mounted within said cooling chamber for sucking air into said cooling chamber through said first port of each article-storage chamber and discharging cooled air into each article-storage chamber through said second port, and first and second shutter means for closing said first and second ports of each article-storage chamber, whereby each article-storage chamber may be used as a heating chamber at a time when said first and second ports are closed by said shutter means and as refrigerating chamber at a time when said first and second ports are open.

2. A vending machine as claimed in Claim 1, wherein each article-storage chamber is provided with a partitioning wall vertically extending in the lower portion thereof to divide said lower portion into two spaces which are respectively connected with said first and second ports therein, said partitioning wall being formed with a hole connecting said divided two spaces, and said hole closed by third shutter means at a time when said first and second ports are open.

3. A vending machine as claimed in Claim 2, wherein one of said first and second shutter means is arranged swingable around an axis so as to serve as said third shutter means, at a time when said one shutter means is swung to open the corresponding one of said first and second ports.

4. A vending machine as claimed in Claim 1 or 3, wherein an operating rod having a handle is disposed in each article-storage chamber to move said first and second shutter means so as to control the closing and opening of both of said first and second ports in each article-storage chamber.

5. A vending machine as claimed in Claim 4, wherein at least one microswitch is mounted near said operating rod in each article-storage chamber to be actuated by the engagement with said operating rod operated to open said first and second ports, the operation of said heating means being controlled by the output of said microswitch, and the operation of said refrigerating system and said blower means controlled by said microswitches in all article-storage chambers.

6. A vending machine as claimed in Claim 1, wherein said cooling chamber is disposed under all of said article-storage chambers, said cooling chamber being partially depressed to form a chamber in which refrigerant compressor, condenser, and other parts of said refrigerating system are contained and which is communicated with outside of said machine cabinet.

7. A vending machine as claimed in Claim 1, wherein said cooling chamber is divided into two spaces by said refrigerant evaporator means which connect with said first and second ports of each article-storage chamber, respectively, a plate member disposed adjacent to said refrigerant evaporator means and having a hole in which said blower means are disposed, said plate member having at least one opening in addition to said hole, and damper means disposed to close said opening but swingable to open said opening by air-pressure difference between said plate member.

8. A vending machine constructed arranged and adapted to operate substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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FIG. 2

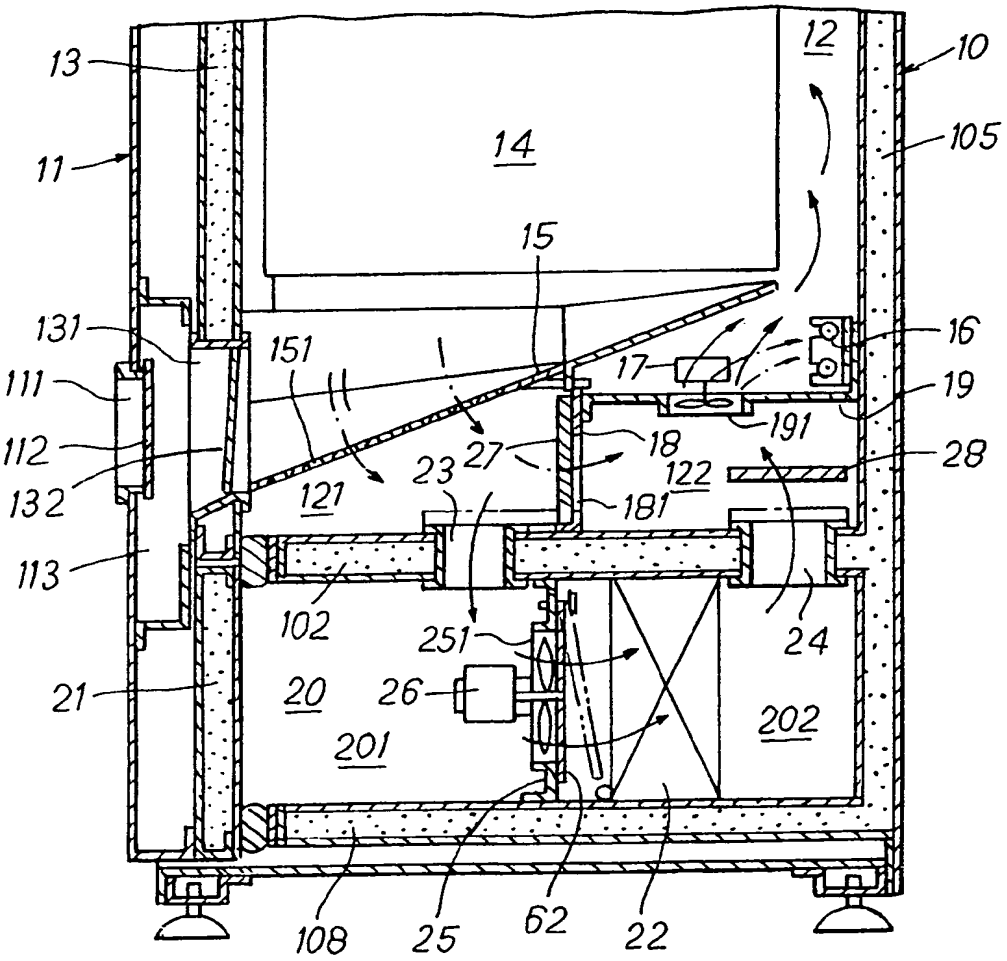

FIG. 3

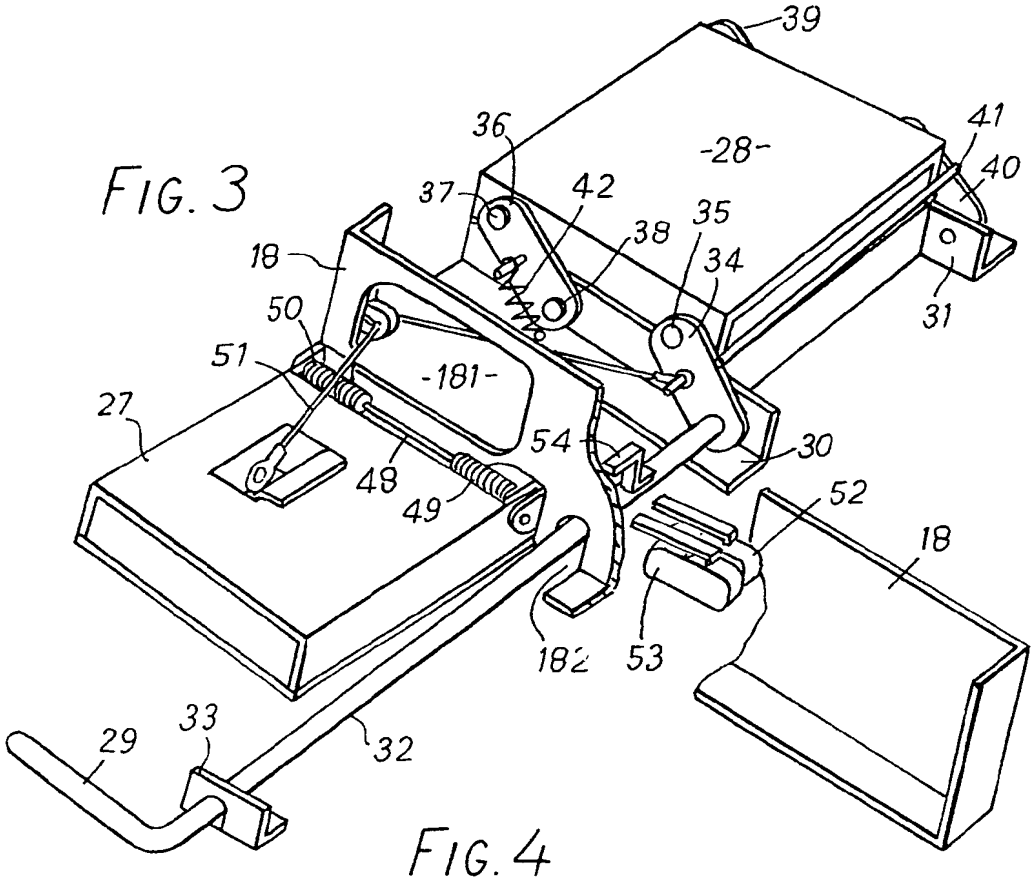

FIG. 4